Physical Review A - Atomic, Molecular, and Optical Physics 2008 vol.78 N2

Efficiency and fidelity of photon-echo quantum memory in an atomic system with longitudinal inhomogeneous broadening

Moiseev S., Arslanov N.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

We have performed a theoretical analysis of the photon-echo-based quantum memory realized recently in A. L. Alexander, Phys. Rev. Lett. 96, 043602 (2006) in the medium with linear correlation between atomic spatial coordinates and frequency detunings of the inhomogeneously broadened transition. A more general vision on the physical picture of temporal and spatial light-atoms dynamics has been obtained in the analytical solutions, taking into account the atomic phase relaxation, inhomogeneous broadening, and arbitrary parameters of the probe light pulses. We have evaluated preferable experimental conditions for the storage of incoming data light field modes where quantum memory efficiency and fidelity have been found. Physics of high efficiency in the forward geometry of the quantum memory and advantages for the realization of more universal long-lived storage on this basis are clarified. © 2008 The American Physical Society.

http://dx.doi.org/10.1103/PhysRevA.78.023803